

# A REVIEW OF THE RANCHOLABREAN AVIFAUNA OF THE ITCHTUCKNEE RIVER, FLORIDA

By Kenneth E. Campbell, Jr.<sup>1</sup>

**ABSTRACT:** A collection of 1363 fossil bird bones representing 56 species is described, bringing the known avifauna from the late Pleistocene (Rancholabrean) deposits of the Itchtucknee River, Florida, to 67 species represented by over 1750 specimens. A predominance of aquatic species indicates the presence of extensive freshwater pond and marsh habitat. A mid-Wisconsinan age, or younger, is suggested for the deposits. The recognition of a paleospecies of *Milvago* (Accipitriformes: Falconidae) in Florida marks the first record of the genus for North America.

The Itchtucknee River, located in Columbia County, Florida, has long been known as a rich source of Pleistocene fossils, including mammals (Simpson 1929, 1930, 1932; Kurtén 1965; Martin 1969), reptiles (Auffenberg 1963), and birds (Wetmore 1931; McCoy 1963).

In the years subsequent to McCoy's report on the paleoavifauna, over 1300 additional specimens of fossil birds have been recovered from the Itchtucknee River by numerous collectors; these form the basis for the present paper. Fossils from the Itchtucknee River are generally found as stream float along the bottom of the river, but they may also be collected as they wash out of the deposits. The avian fossils reported here were collected from a number of sites. Although the locality is given as simply "Itchtucknee River," some specimens have more specific locality data. The specimens reported below are part of the collections of the Florida State Museum, University of Florida.

As discussed by McCoy (1963), the Itchtucknee River is considered a Pleistocene, possibly mid-Wisconsinan, locality. Webb (1974) lists it among the Rancholabrean sites of Florida based on the mammalian taxa contained therein. The exact age of most of the specimens reported here cannot be determined because the river is eroding deposits of probably different ages, and often redepositing fossils on younger sediments. Fossils of different ages are often mixed on the river bottom. Also, because the river meanders in places, the processes of erosion and redeposition continued over time have resulted in deposits containing fossils of mixed ages; these are now being exposed on the bottom of the river once again. I do not believe any of the fossils are older than Rancholabrean, but because of the mixing action of the river there may be a few post-Rancholabrean fossils inadvertently included. Comments by McCoy (1963) as to the type of preservation of the fossil materials and the nature of the river and specific sites are still pertinent and will not be repeated here.

The following faunal list includes only those specimens I identified; the fossils identified by McCoy are listed in Table 1. Many of the specimens identified by McCoy (1963) have been rechecked, either by myself or others, resulting in the correction of some misidentifications (see Table 1). A check of all McCoy's identifications would be very difficult because he reported on fossils from four different collections and did not give catalog numbers of most of the specimens he listed.

## FAUNAL LIST

### *Podilymbus podiceps* (Linnaeus 1758)

#### Pied-billed Grebe

**MATERIAL:** Coracoids (19); humeri (55); ulnae (7); carpo-metacarpi (2); femora (17); tibiotarsi (22); tarsometatarsi (31). UF/FSM 15209–15213, 15215–15219, 15221–15222, 15224–15324, 22305–22341.

**REMARKS:** Storer (1976) studied most of the material listed above for his report on Pleistocene Pied-billed Grebes. I concur with his conclusion that *P. magnus* should be regarded as a synonym of *P. podiceps*.

### *Podilymbus wetmorei* Storer 1976

**MATERIAL:** Two complete left femora, 1 complete left tarsometatarsus. UF/FSM 15214, 15220, 15223.

**REMARKS:** Storer (1976) referred these specimens to *P. wetmorei* in his original description of that species on the grounds that the femora are much heavier and the tarsometatarsus is much thicker than those of *P. podiceps*. Although I agree with Storer that the specimens referred to *P. wetmorei* are significantly larger than corresponding bones of *P. podiceps*, I think there is a good possibility that the former may have been a resident race of *P. podiceps* in peninsular Florida during the Pleistocene. The type locality for *P. wetmorei* is the Dixie Lime Products quarry, Locality IA, 1.6 km south of Reddick, Marion County, Florida. The lack of any good osteological characters other than size that separate *P. podiceps* and *P. wetmorei* might be taken as evidence for this possibility.

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Table 1. Avian species from the late Pleistocene deposits of the Itchtucknee River, Florida.

| Species                         | (From McCoy 1963)   |                               | Added               |                               | Total               |                               |
|---------------------------------|---------------------|-------------------------------|---------------------|-------------------------------|---------------------|-------------------------------|
|                                 | Number of Specimens | Minimum Number of Individuals | Number of Specimens | Minimum Number of Individuals | Number of Specimens | Minimum Number of Individuals |
| <i>Podilymbus podiceps</i>      | 60 <sup>1</sup>     | 4                             | 150                 | 27                            | 210                 | 31*                           |
| † <i>Podilymbus wetmorei</i>    | 0                   | 0                             | 3                   | 2                             | 3                   | 2                             |
| <i>Podiceps auritus</i>         | 1                   | 1                             | 0                   | 0                             | 1                   | 1                             |
| <i>Phalacrocorax auritus</i>    | 21                  | 3                             | 74                  | 9                             | 95                  | 12*                           |
| <i>Anhinga anhinga</i>          | 1                   | 1                             | 3                   | 2                             | 4                   | 2                             |
| <i>Ardea herodias</i>           | 8                   | 2                             | 39                  | 8                             | 47                  | 8                             |
| <i>Casmerodius albus</i>        | 0 <sup>2</sup>      | 0                             | 1                   | 1                             | 1                   | 1                             |
| <i>Butorides virescens</i>      | 1                   | 1                             | 0                   | 0                             | 1                   | 1                             |
| <i>Egretta caerulea</i>         | 1 <sup>3</sup>      | 1                             | 1                   | 1                             | 2                   | 2*                            |
| <i>Nycticorax nycticorax</i>    | 2                   | 1                             | 4                   | 1                             | 6                   | 2*                            |
| <i>Botaurus lentiginosus</i>    | 2 <sup>4</sup>      | 1                             | 3                   | 1                             | 5                   | 1                             |
| † <i>Ciconia maltha</i>         | 2                   | 1                             | 9                   | 2                             | 11                  | 2                             |
| <i>Mycteria americana</i>       | 0 <sup>5</sup>      | 0                             | 3                   | 1                             | 3                   | 1                             |
| <i>Eudocimus albus</i>          | 1                   | 1                             | 0                   | 0                             | 1                   | 1                             |
| <i>Olor columbianus</i>         | 1                   | 1                             | 9                   | 4                             | 10                  | 4                             |
| <i>Olor buccinator</i>          | 15                  | 5                             | 47                  | 5                             | 62                  | 5                             |
| <i>Branta canadensis</i>        | 25 <sup>6</sup>     | 4                             | 83                  | 9                             | 108                 | 9                             |
| <i>Anas platyrhynchos</i>       | 19 <sup>7</sup>     | 3                             | 144                 | 24                            | 163                 | 24                            |
| <i>Anas rubripes</i>            | 6                   | 2                             | 10                  | 4                             | 16                  | 6                             |
| <i>Anas acuta</i>               | 6                   | 2                             | 25                  | 4                             | 31                  | 5                             |
| <i>Anas discors</i>             | 16                  | 6                             | 30                  | 9                             | 46                  | 9                             |
| † <i>Anas itchtucknee</i>       | 1                   | 1                             | 0                   | 0                             | 1                   | 1                             |
| <i>Anas crecca</i>              | 3                   | 1                             | 4                   | 2                             | 7                   | 2                             |
| <i>Anas strepera</i>            | 4                   | 1                             | 11                  | 4                             | 15                  | 4                             |
| <i>Anas americana</i>           | 5                   | 4                             | 3                   | 1                             | 8                   | 4                             |
| <i>Anas clypeata</i>            | 5                   | 2                             | 32                  | 8                             | 37                  | 9                             |
| <i>Aix sponsa</i>               | 9                   | 3                             | 27                  | 7                             | 36                  | 8*                            |
| <i>Aythya affinis</i>           | 17                  | 4                             | 40                  | 14                            | 57                  | 17*                           |
| <i>Aythya collaris</i>          | 25                  | 10                            | 115                 | 22                            | 140                 | 32*                           |
| <i>Aythya americana</i>         | 2                   | 1                             | 2                   | 1                             | 4                   | 2                             |
| <i>Aythya valisineria</i>       | 16                  | 4                             | 95                  | 15                            | 111                 | 15                            |
| <i>Bucephala clangula</i>       | 0                   | 0                             | 3                   | 2                             | 3                   | 2                             |
| <i>Bucephala albeola</i>        | 1                   | 1                             | 0                   | 0                             | 1                   | 1                             |
| <i>Lophodytes cucullatus</i>    | 4                   | 2                             | 12                  | 5                             | 16                  | 8*                            |
| <i>Mergus merganser</i>         | 1                   | 1                             | 0                   | 0                             | 1                   | 1                             |
| <i>Mergus serrator</i>          | 0                   | 0                             | 1                   | 1                             | 1                   | 1                             |
| <i>Oxyura jamaicensis</i>       | 0                   | 0                             | 5                   | 1                             | 5                   | 1                             |
| <i>Cathartes aura</i>           | 0                   | 0                             | 2                   | 1                             | 2                   | 1                             |
| <i>Coragyps atratus</i>         | 1                   | 1                             | 1                   | 1                             | 2                   | 1                             |
| † <i>Gymnogyps amplus</i>       | 1                   | 1                             | 0                   | 0                             | 1                   | 1                             |
| Accipitridae gen. et sp. indet. | 1 <sup>8</sup>      | 1                             | 1                   | 1                             | 2                   | 1                             |
| <i>Buteo lineatus</i>           | 0                   | 0                             | 3                   | 1                             | 3                   | 1                             |
| <i>Buteo jamaicensis</i>        | 1                   | 1                             | 6                   | 3                             | 7                   | 3                             |
| <i>Haliaetus leucocephalus</i>  | 0                   | 0                             | 3                   | 2                             | 3                   | 2                             |
| † <i>Milvago readei</i>         | 0                   | 0                             | 2                   | 1                             | 2                   | 1                             |
| <i>Pandion haliaetus</i>        | 10                  | 3                             | 15                  | 5                             | 25                  | 6*                            |
| <i>Colinus virginianus</i>      | 0                   | 0                             | 4                   | 1                             | 4                   | 1                             |
| <i>Meleagris gallopavo</i>      | 27                  | 9                             | 141                 | 18                            | 168                 | 23*                           |
| <i>Grus americana</i>           | 3                   | 1                             | 16                  | 3                             | 19                  | 3                             |
| <i>Grus canadensis</i>          | 0                   | 0                             | 3                   | 1                             | 3                   | 1                             |
| <i>Aramus guarana</i>           | 0                   | 0                             | 4                   | 1                             | 4                   | 1                             |
| <i>Rallus elegans</i>           | 2                   | 1                             | 4                   | 1                             | 6                   | 2*                            |
| <i>Rallus limicola</i>          | 1                   | 1                             | 0                   | 0                             | 1                   | 1                             |
| <i>Porzana carolina</i>         | 1                   | 1                             | 1                   | 1                             | 2                   | 1                             |
| <i>Gallinula chloropus</i>      | 15                  | 3                             | 63                  | 7                             | 78                  | 7                             |
| † <i>Gallinula brodkorbi</i>    | 5                   | 3                             | 29                  | 5                             | 34                  | 5                             |
| <i>Porphyryla martinica</i>     | 0                   | 0                             | 7                   | 3                             | 7                   | 3                             |
| <i>Fulica americana</i>         | 38 <sup>9</sup>     | 11                            | 55                  | 16                            | 93                  | 27                            |
| † <i>Ectopistes migratorius</i> | 0                   | 0                             | 1                   | 1                             | 1                   | 1                             |
| <i>Zenaidura macroura</i>       | 0                   | 0                             | 1                   | 1                             | 1                   | 1                             |
| <i>Tyto alba</i>                | 1 <sup>10</sup>     | 1                             | 1                   | 1                             | 2                   | 1                             |
| <i>Otus asio</i>                | 0                   | 0                             | 2                   | 1                             | 2                   | 1                             |
| <i>Strix varia</i>              | 0                   | 0                             | 1                   | 1                             | 1                   | 1                             |
| <i>Colaptes auratus</i>         | 1                   | 1                             | 0                   | 0                             | 1                   | 1                             |

Table 1. Continued.

| Species                      | (From McCoy 1963)   |                               | Added               |                               | Total               |                               |
|------------------------------|---------------------|-------------------------------|---------------------|-------------------------------|---------------------|-------------------------------|
|                              | Number of Specimens | Minimum Number of Individuals | Number of Specimens | Minimum Number of Individuals | Number of Specimens | Minimum Number of Individuals |
| <i>Corvus brachyrhynchos</i> | 0                   | 0                             | 9                   | 2                             | 9                   | 2                             |
| <i>Agelaius phoeniceus</i>   | 1                   | 1                             | 0                   | 0                             | 1                   | 1                             |
| <i>Quiscalus quiscula</i>    | 2                   | 1                             | 0                   | 0                             | 2                   | 1                             |

† Extinct species.

\* Approximate only. Total obtained by adding figures of McCoy with those reported on here, which will not necessarily give an accurate minimum number.

<sup>1</sup> Including 2 specimens listed as *Podilymbus magnus* Shufeldt. However, in his formal list McCoy stated there were 47 specimens of *P. podiceps*, not 58 as listed in his table.<sup>2</sup> McCoy referred this specimen to *Casmerodius albus*.<sup>3</sup> McCoy listed this species in his table, but did not include it in his faunal list.<sup>4</sup> McCoy referred this specimen, a complete humerus, to *Branta canadensis*.<sup>5</sup> Including two specimens referred to *Palaeophox columbiana* by McCoy.<sup>6</sup> I have combined here the two subspecies of *Branta canadensis* listed by McCoy.<sup>7</sup> Including specimens listed as *Anas fulvigula* by McCoy.<sup>8</sup> McCoy referred this specimen to *Teratornis merriami*.<sup>9</sup> Including specimen assigned to *Fulica minor* Shufeldt, considered a synonym of *F. americana* (Olson 1977).<sup>10</sup> Including specimen referred to *Palaeophox columbiana* by McCoy.*Phalacrocorax auritus* (Lesson 1831)

## Double-crested Cormorant

MATERIAL: Maxilla; mandible; coracoids (11); scapulae (2); humeri (11); ulnae (22); radius; carpometacarpi (5); femora (4); tibiotarsi (8); tarsometatarsi (8). UF/FSM 15454–15522, 15646, 20014–20015, 22451.

*Anhinga anhinga* (Linnaeus 1766)

## Anhinga

MATERIAL: Humerus; ulnae (2). UF/FSM 22459–22551.

*Ardea herodias* Linnaeus 1758

## Great Blue Heron

MATERIAL: Coracoids (4); scapulae (2); humeri (3); ulnae (5); radii (2); carpometacarpi (4); femora (2); tibiotarsi (5); tarsometatarsi (12). UF/FSM 15535–15571, 20012, 22559.

*Casmerodius albus* (Linnaeus 1758)

## Great Egret

MATERIAL: Ulna. UF/FSM 15572.

*Egretta caerulea* (Linnaeus 1758)

## Little Blue Heron

MATERIAL: Tibiotarsus. UF/FSM 15534.

*Nycticorax nycticorax* (Linnaeus 1758)

## Black-crowned Night-Heron

MATERIAL: Ulna; carpometacarpus; femur; tarsometatarsus. UF/FSM 15531–15533, 20013.

*Botaurus lentiginosus* (Rachett 1813)

## American Bittern

MATERIAL: Humerus; tibiotarsus; tarsometatarsus. UF/FSM 20019, 22536–22537.

REMARKS: McCoy (1963) described a new genus and

species of heron, *Paleophox columbiana*, from the Itchtucknee River on the basis of two coracoids and an ulna. Olson (1974) published a reappraisal of this heron, stating that he could find no characters to separate the coracoids from those of *Botaurus lentiginosus*, while the ulna represented the Barn Owl, *Tyto alba*. He stated that the coracoids fell at or slightly below (1 mm) the lower size range of Recent *B. lentiginosus*, and suggested that *B. lentiginosus* may have been smaller during the Pleistocene. The specimens listed above all fall well within the size range of Recent *B. lentiginosus*, indicating that *B. lentiginosus* was not significantly smaller during the Pleistocene.

*Ciconia maltha* L. Miller 1910

MATERIAL: Coracoid; scapula; humeri (2); carpometacarpus; tibiotarsi (3); tarsometatarsus. UF/FSM 1963, 15525–15530, 15591, 22555.

*Mycteria americana* Linnaeus 1758

## American Wood-Ibis

MATERIAL: Ulna; tarsometatarsi (2). UF/FSM 15592–15594.

REMARKS: Olson (pers. comm.) has suggested that because of their large size these specimens may represent *Mycteria wetmorei* Howard.

*Olor columbianus* (Ord 1815)

## Whistling Swan

MATERIAL: Scapula; humeri (2); ulna; femur; tarsometatarsi (4). UF/FSM 15619–15620, 15659–15663, 15665, 15668.

*Olor buccinator* Richardson 1831

## Trumpeter Swan

MATERIAL: Cranium; coracoids (4); scapula; humeri (7); ulnae (8); radii (6); carpometacarpi (6); pelvis; femora (2); tib-

iotarsi (5); tarsometatarsi (5). UF/FSM 13988, 15613–15618, 15621–15658, 15666, 22449.

REMARKS: Although *Olor columbianus* has been reported as a rare winter resident in Florida (AOU 1957), *O. buccinator* is known from Florida only on the basis of fossils, and only from the Itchtucknee River (Wetmore 1931). This may suggest that the range of *O. buccinator* was shifted southward during glacial periods of the Pleistocene, and retreated northward during inter- and postglacial periods. It should be noted that there are six times as many specimens of *O. buccinator* reported here as there are of *O. columbianus*.

*Branta canadensis* Linnaeus 1758

Canada Goose

MATERIAL: Coracoids (16); scapulae (4); humeri (12); ulnae (16); radii (9); carpometacarpi (8); sternum; femora (5); tibiotarsi (7); tarsometatarsi (5). UF/FSM 14104, 15669–15705, 22492–22535, 22548.

*Anas platyrhynchos* Linnaeus 1758

Mallard

MATERIAL: Coracoids (26); scapulae (8); humeri (50); ulnae (25); radius; carpometacarpi (24); femora (2); tibiotarsi (15); tarsometatarsi (2). UF/FSM 2393, 2978, 15774–15783, 19477–19617, 22483.

REMARKS: Undoubtedly included in the material listed above are specimens of *Anas rubripes*, a species so similar osteologically to *A. platyrhynchos* that bones of the two are extremely difficult, if not impossible, to separate. If any of the material above is from *A. rubripes*, I consider specimens UF/FSM 15774–15783 to be the best possibilities.

*Anas acuta* Linnaeus 1758

Pintail

MATERIAL: Coracoids (7); humeri (6); ulnae (4); carpometacarpi (7); tibiotarsus. UF/FSM 15784–15808.

*Anas discors* Linnaeus 1766

Blue-winged Teal

MATERIAL: Coracoids (4); humeri (14); ulnae (5); carpometacarpi (4); tibiotarsi (2); tarsometatarsus. UF/FSM 15881–15910.

*Anas crecca* Linnaeus 1758

Green-winged Teal

MATERIAL: Humeri (4). UF/FSM 15911–15914.

*Anas strepera* Linnaeus 1758

Gadwall

MATERIAL: Coracoids (6); ulnae (2); carpometacarpi (3). UF/FSM 15724–15734.

*Anas americana* Gmelin 1789

Baldpate

MATERIAL: Coracoid; carpometacarpi (2). UF/FSM 15720–15721, 16831.

*Anas clypeata* Linnaeus 1758

Shoveler

MATERIAL: Coracoids (8); humeri (8); ulnae (6); carpometacarpi (10). UF/FSM 15809–15840.

*Aix sponsa* (Linnaeus 1758)

Wood Duck

MATERIAL: Coracoids (4); scapulae (2); humeri (12); ulnae (5); carpometacarpi (2); femur; tibiotarsus. UF/FSM 15747–15773.

*Aythya affinis* (Eyton 1838)

Lesser Scaup

MATERIAL: Coracoids (7); humeri (24); ulnae (3); carpometacarpi (5); tarsometatarsus. UF/FSM 15841–15880.

*Aythya collaris* (Donovan 1809)

Ring-necked Duck

MATERIAL: Coracoids (35); scapulae (5); humeri (52); ulnae (8); carpometacarpi (6); femur; tibiotarsi (5); tarsometatarsi (3). UF/FSM 1749, 14092, 16007–16100, 14458–14476.

*Aythya americana* (Eyton 1838)

Redhead

MATERIAL: Coracoid; ulna. UF/FSM 15722–15723.

*Aythya valisineria* (Wilson 1814)

Canvasback

MATERIAL: Crania (3); coracoids (25); scapulae (4); humeri (34); ulnae (10); carpometacarpi (12); femora (4); tibiotarsi (2); tarsometatarsus. UF/FSM 2000, 14092, 15915–16006, 22484.

*Bucephala clangula* (Linnaeus 1758)

Common Goldeneye

MATERIAL: Coracoid; humeri (2). UF/FSM 15716–15718.

*Lophodytes cucullatus* (Linnaeus 1758)

Hooded Merganser

MATERIAL: Coracoid; humeri (8); ulnae (2); femur. UF/FSM 15735–15746.

*Mergus serrator* Linnaeus 1758

Red-breasted Merganser

MATERIAL: Carpometacarpus. UF/FSM 15719.

*Oxyura jamaicensis* (Gmelin 1789)

Ruddy Duck

MATERIAL: Coracoid; humerus; ulna; tibiotarsus; tarsometatarsus. UF/FSM 15711–15715.

*Cathartes aura* (Linnaeus 1758)

Turkey Vulture

MATERIAL: Humerus; tibiotarsus. UF/FSM 15595, 20016.

*Coragyps atratus* (Bechstein 1793)

Black Vulture

MATERIAL: Tarsometatarsus. UF/FSM 20018.



### Accipitridae genus and species indeterminate

**MATERIAL:** Proximal end of left tibiotarsus (Collection of Pierce Brodkorb No. PB 1874); distal end of left tarsometatarsus (UF/FSM 22560).

**REMARKS:** These specimens are from a large eagle, but they are too fragmentary to yield any diagnostic characters. They do not represent a living species, or *Amplibuteo woodwardi* (L. Miller). The tibiotarsus was referred to *Teratornis merriami* L. Miller by McCoy (1963). Olson (pers. comm.) has reported a fragmentary distal end of a tarsometatarsus (USNM 209535) from the late Pleistocene deposits of the Aucilla River, Florida, that is also from a large eagle, but it is different from the tarsometatarsus listed above. So there were at least two large, presently unknown, eagles living in Florida in the late Pleistocene.

### *Buteo lineatus* (Gmelin 1788) Red-shouldered Hawk

**MATERIAL:** Humerus; carpometacarpus; tibiotarsus. UF/FSM 22453–22454, 22491.

### *Buteo jamaicensis* (Gmelin 1788) Red-tailed Hawk

**MATERIAL:** Femur; tibiotarsus; tarsometatarsi (4). UF/FSM 15608–15612, 22452.

### *Haliaeetus leucocephalus* (Linnaeus 1766) Bald Eagle

**MATERIAL:** Carpometacarpi (3). UF/FSM 22446–22448.

### Genus *Milvago* Spix 1824 *Milvago readei* (Brodkorb 1959)

**MATERIAL:** Distal end and shaft of right tibiotarsus; distal end of left tarsometatarsus. UF/FSM 22561–22562. Figures 1a–c, 2b–d, 3.

**REMARKS:** *Milvago readei* was described by Brodkorb (1959) as a species of *Falco* on the basis of a fragmentary distal end of a left tibiotarsus (Fig. 1b, d). The type locality is Pit 2, Arredondo (Arredondo II), Alachua County, Florida. The type horizon is the Arredondo clay member of the Wicomico Formation, which Brodkorb considered to be Illinoian. In a study of the fossil box turtles (*Terrapene*) of Florida, Auffenberg (1958) also considered Arredondo II to be Illinoian, although he considered the possibility that the nearby Arredondo IA deposits might be referred to the Sangamon. Martin (1968) considered the Arredondo IA deposits to be either Illinoian, Sangamon, or Wisconsinan in age; the thrust of his paper, however, requires that the deposits be of a glacial age. No other fossils have been referred to this species since its description.

The holotype of *Milvago readei* was described as being similar to *Falco mexicanus*, but differing by having "(1) external ligamental prominence a small knob; (2) no shelf connecting external ligamental prominence and groove for peroneus profundus; (3) intercondylar pit elongated in an obliquely transverse direction toward anterior edge of external condyle; (4) size about half. Distal width, 8.0; depth of external condyle,

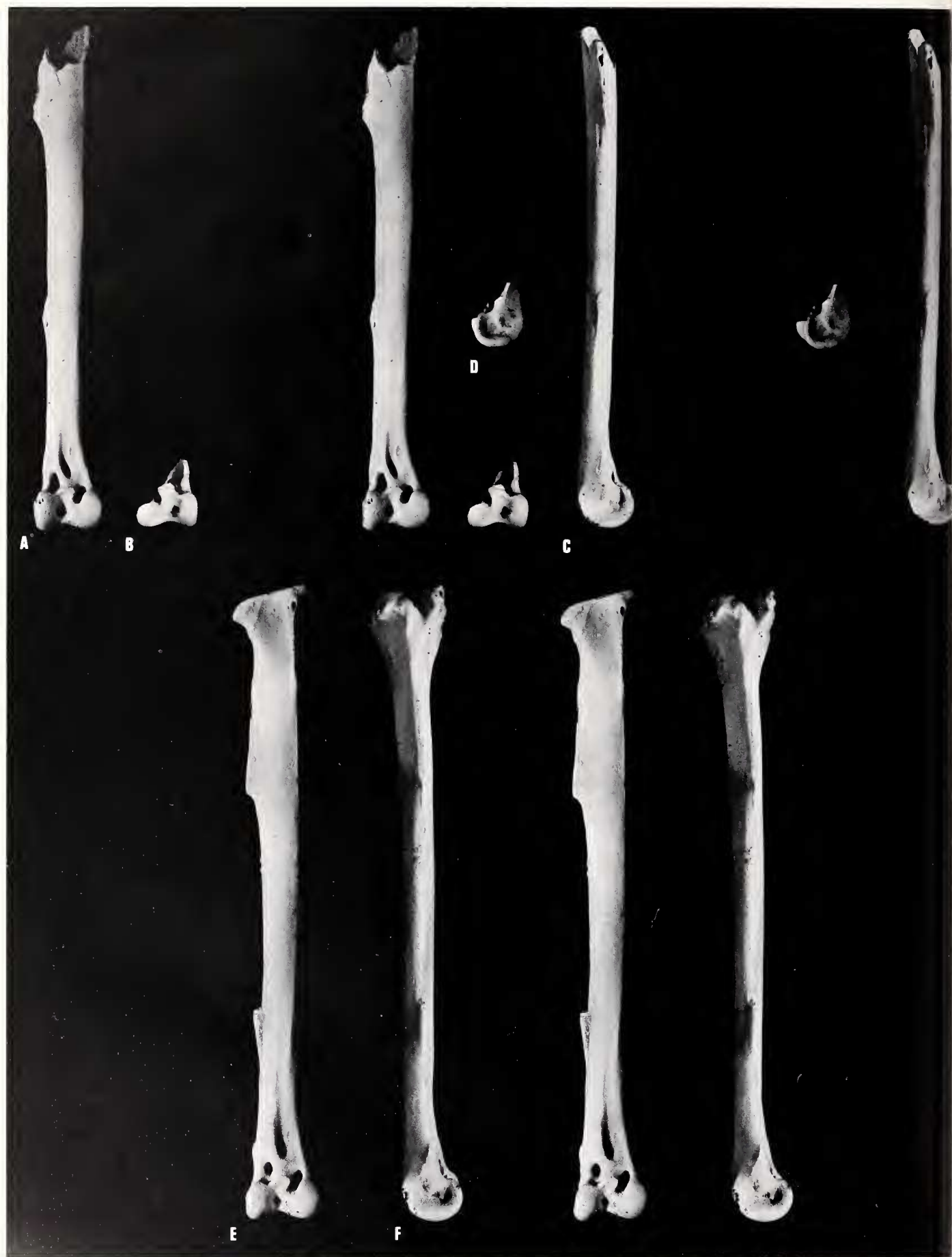
6.5; anterior height of external condyle, 4.7; depth of internal condyle, about 6.5 mm" (Brodkorb 1959:274–275). I consider characters (1) and (2) to be valid at the generic level, and that character (3) may also serve to separate *Falco* from *Milvago*.

The tibiotarsus from the Itchtucknee River differs from the holotype of *M. readei* in only minor details, such as having a smaller opening in the intercondylar fossa and a more prominent posteroproximal corner to the external condyle. Both of these are variable characters. The holotype tibiotarsus is slightly, but insignificantly, smaller than that from the Itchtucknee River. Measurements (in mm) of the latter are: Distal width 8.8; depth of external condyle 7.2; anterior height of external condyle 5.2; depth of internal condyle 7.3; least width of shaft 4.9. (For additional measurements of *Milvago* spp., see Olson 1976a:358; Campbell 1979:96–99.)

The Itchtucknee River tibiotarsus (Fig. 1a, c) is characterized by having the (1) external condyle with very deep concavity on external surface (moderately deep in *M. chimango* Vieillot; deep in *M. chimachima* Vieillot; similar in *M. brodkorbi* Campbell 1979); (2) internal condyle with moderate concavity on posterointernal side (shallow in *M. chimango*; deep in *M. chimachima*; similar in *M. brodkorbi*); (3) anterior intercondylar fossa with very deep pit on external side (shallow to moderately deep pit in *M. chimango* and *M. chimachima*; deep pit in *M. brodkorbi*); (4) intercondylar groove shallow in anterior view (deeper in *M. chimango*, *M. chimachima*, and *M. brodkorbi*); (5) external condyle deeply undercut by very large tendinal fossa (very restricted fossa in *M. chimango* and *M. chimachima*; similar in *M. brodkorbi*); (6) supratendinal bridge with proximal end positioned near external edge of shaft (positioned farther from external edge of shaft in *M. chimango*, *M. chimachima*, and *M. brodkorbi*); (7) shaft sturdy (similar in *M. chimango* and *M. brodkorbi*; more slender in *M. chimachima*). No tibiotarsus is known for *M. alexandri* Olson 1976.

The tarsometatarsus (Figs. 2b–d, 3) from the Itchtucknee River assigned to *M. readei* is referable to the subfamily Polyborinae on the basis of having the middle trochlea project distad much more than the inner trochlea (in the subfamily Falconinae the inner trochlea projects distad as much as or more than the middle trochlea). With the exception of *Spizapteryx* (Olson 1976a), the species of the subfamilies Herpetotherinae (Forest Falcons) and Polihieracinae (Pigmy Falcons) have very distinctive tarsometatarsi that do not closely resemble those of the caracaras or falcons.

The tarsometatarsus agrees with that of *Milvago* and differs from those of all other genera of the subfamily Polyborinae (*Daptrius*, *Phalcoboenus*, and *Polyborus*) by having (1) trochleae laterally compressed; (2) middle trochlea widening markedly distad in both anterior and posterior view, and with external edge projecting more posteriad than internal edge; (3) inner trochlea not rotated or rotated slightly to moderately posteriad, with anterior surface flush with that of shaft; i.e., no point of trochlear surface extending anterior to shaft surface; (4) inner trochlea with wing (posterior projection) roughly perpendicular to long axis of shaft without turning distad at tip; (5) inner trochlea with broad flattened area on inner half of posterior side; delineated by distinct sharp edge leading from anteroproximal edge of base to tip of wing and a ridge leading from end of metatarsal facet to tip of wing.



The tarsometatarsus is characterized by having (1) inner trochlea with wing moderately large (much smaller and projecting posteriad less in *M. chimango* and *M. alexandri*; broader, but projecting posteriad less in *M. chimachima*; similar, but more massive and with only slight convexity on distal, or internal, surface in *M. brodkorbi*) (Fig. 2a, e, f); (2) inner trochlea rotated moderately posteriad (not rotated in *M. chimango*, *M. chimachima*, and *M. alexandri*; rotated slightly in *M. brodkorbi*); (3) internal intertrochlear notch narrow and deep (narrow and shallow in *M. chimango*; narrow and moderately deep in *M. chimachima*; moderately wide and deep in *M. alexandri*; wide and deep in *M. brodkorbi*); (4) middle trochlea with trochlear groove broad and shallow (similar, but not as broad in *M. chimango*; narrow and deeper in *M. chimachima*; similar in *M. alexandri*; similar, but slightly deeper in *M. brodkorbi*); (5) groove leading proximad from internal intertrochlear notch and skirting medial edge of metatarsal facet quite well marked; i.e., distinctly visible (slightly marked in *M. chimango*, *M. alexandri*, and *M. brodkorbi*; not visible in *M. chimachima*); (6) shaft broad with very pronounced ridge leading proximad from metatarsal facet (highly variable width, but only slight ridge in *M. chimango* and *M. chimachima*; slightly narrower with moderately pronounced ridge in *M. alexandri*; broader, with similar ridge in *M. brodkorbi*); (7) metatarsal facet large (smaller in *M. chimango*, *M. chimachima*, and *M. alexandri*; similar in *M. brodkorbi*). The tarsometatarsus is most similar in size to those of *M. chimachima*, but as the external trochlea is broken the only measurements that can be taken are as follows (in mm): Distal width (est.) 8.8; width of middle trochlea 3.4; depth of middle trochlea 4.3.

No tarsometatarsus is known for *M. readei*, but I doubt that there was more than one species in Florida at any given time during the Pleistocene. I consider referral of the tarsometatarsus to *M. readei* appropriate.

**DISCUSSION:** Prior to 1976 there were only two known species of *Milvago*, *M. chimango* and *M. chimachima*, both living in and restricted to South America, Panama, and Costa Rica. Olson (1976) described the first recognized paleospecies of *Milvago*, *M. alexandri*, on the basis of a complete tarsometatarsus from late Pleistocene cave deposits in Haiti, Hispaniola. Recently, I described the second known paleospecies, *M. brodkorbi*, on the basis of 160 specimens from the late Pleistocene Talara Tar Seeps of northwestern Peru (Campbell 1979). To these four species we can now add another, *M. readei*, from the late Pleistocene of Florida. This is the first record of the genus from North America. Not only is the rapid proliferation of fossil species in such a short time for a genus that previously had no fossil record remarkable, it is even more so considering that all three paleospecies have been found outside the present ranges of the living species. Also, the fact that the paleospecies are all known from late Pleistocene deposits is most interesting. Why should a genus, which appears to have been so successful, suddenly, relatively speaking, have three species in widely separated areas become extinct? Olson

(1976:359) also puzzled over the lack of a clear reason for the extinction of *M. alexandri* on Hispaniola.

The proximity of *M. readei* and *M. alexandri* in time and space poses the question of whether they are both valid species, a question that becomes even stronger considering how few specimens there are for each. Based upon an examination of tibiotarsi (25) and tarsometatarsi (19) of *M. brodkorbi*, I consider intraspecific variation in *Milvago* to be relatively small. There are variable characters, but the species of *Milvago* do not appear to be nearly as variable osteologically as species of the related genus *Polyborus*. Of the seven characters listed for the tarsometatarsus, I consider the first two to be the most important. They reflect rather significant structural differences, and they varied only minimally in the sample of tarsometatarsi of *M. brodkorbi*. Although there is the possibility that larger samples would demonstrate greater variability, I consider *M. readei* and *M. alexandri* to be valid paleospecies on the basis of the currently available material.

Any speculation as to the evolution and development within the genus *Milvago* is very tenuous, based as it would be on such widely scattered data points; but a few comments can be made. Olson (1976) considered *M. alexandri* from Hispaniola more similar to *M. chimachima* than to *M. chimango*, while I considered *M. brodkorbi* from Peru to be more similar to *M. chimango* (Campbell 1979). I believe *M. readei* is more similar to *M. brodkorbi* than to either of the living species, but more similar to *M. chimachima* than *M. chimango*. There are so few comparable characters between *M. alexandri* and *M. readei* that it is impossible to suggest a similarity, or lack of same.

The living species of *Milvago* are open country, savanna, scrub forest, or forest edge inhabitants (Brown and Amadon 1968; Blake 1977). *M. chimachima* ranges from Panama and Costa Rica southward east of the Andes to northern Argentina, while *M. chimango* ranges southward from eastern Bolivia on both sides of the Andes. The two species are sympatric over a wide area of their ranges, but show no tendency to hybridize (Vuilleumier 1970). While the two species are clearly related, and some would even place them as members of a superspecies (Brown and Amadon 1968), they are quite distinct morphologically (Olson 1976).

For now it appears best to assume a South American origin for the genus, and also, to assume that habitat changes resulting from Pleistocene climatic events (Häffer 1974, 1978; Simpson and Häffer 1978; Müller 1973; Vanzolini and Williams 1970; Campbell in press) were instrumental in the speciation within this genus. *M. readei* probably extended its range into Florida via the Gulf Coast Savanna Corridor (Webb 1974) during one of the glacial periods of the Pleistocene. Florida was covered by much open savanna during dry phases of the Pleistocene when the corridor was open (Webb 1974; Watts 1971), and would have been ideal habitat for a species of *Milvago*. At the end of the Pleistocene, Florida lost most of its open country, retaining only the grasslands of the southern-

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Figure 1. Stereophotographs of tibiotarsi of *Milvago*: *Milvago readei*, referred right tibiotarsus, UF/FSM 22562, in anterior (a) and external (c) view; *Milvago readei*, holotype left tibiotarsus, PB 1632, in anterior (b) and external (d) view; *Milvago brodkorbi*, right tibiotarsus, Royal Ontario Museum ROM 17580, in anterior (e) and external (f) view. All  $\times 1.5$ .



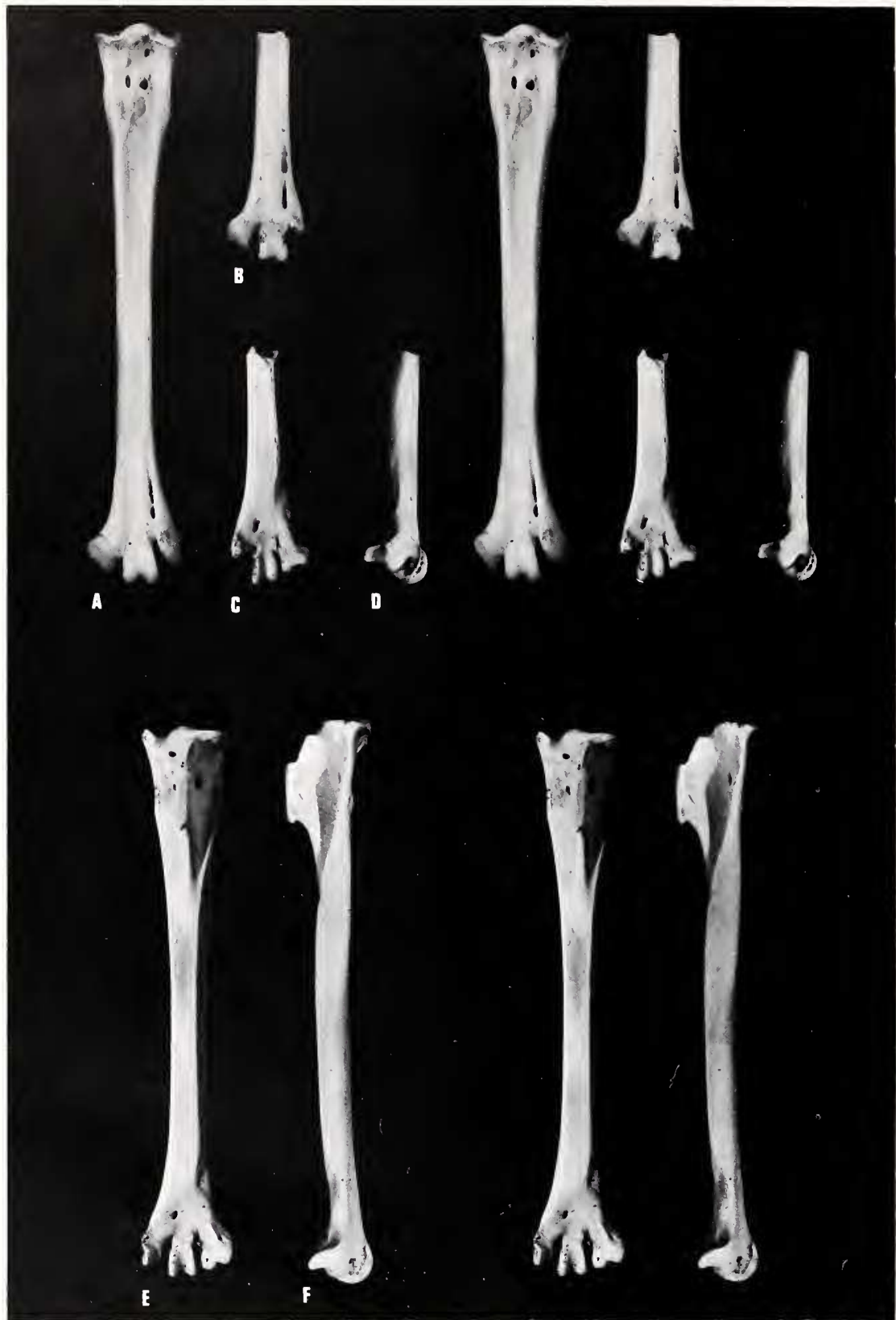


Figure 2. Stereophotographs of left tarsometatarsi of *Milvago*: *Milvago brodkorbi*, holotype, ROM 17447, in anterior (a), posterior (e), and internal (f) view; *Milvago readei*, referred, UF/FSM 22561, in anterior (b), posterior (c), and internal (d) view. All  $\times 1.5$ .



most part of the state. Many other factors may have been responsible for the extinction of *M. readei*, but the climatic and vegetational changes at the end of the Pleistocene that resulted in the loss of the dry savanna habitat in Florida were probably the most important. Whether there were similar habitat changes on Hispaniola is not known at the present time. There are wide areas of xeric vegetation present on Hispaniola today (Wetmore and Swales 1931), although some of this is a result of human habitat alteration. But factors other than climate may also have played a role in the extinction of *M. al-exandri*.

*Pandion haliaetus* (Linnaeus 1758)

Osprey

MATERIAL: Coracoids (3); ulnae (2); tibiotarsi (4); tarso-metatarsi (6). UF/FSM 2725, 15596–15607, 22547, 22548.

*Colinus virginianus* (Linnaeus 1758)

Bobwhite

MATERIAL: Humeri (2); tibiotarsi (2). UF/FSM 15523–15524, 22455–22456.

*Meleagris gallopavo* Linnaeus 1758

Wild Turkey

MATERIAL: Coracoids (9); scapula; humeri (12); ulnae (11); carpometacarpi (14); sternum; pelves (2); femora (10); tibiotarsi (34); tarsometatarsi (47). UF/FSM 2069, 2332, 13988, 14104, 14126, 15328–15453, 15664, 15667, 16832, 22298–22304.

REMARKS: This series of fossils is discussed by Steadman (this vol.)

*Grus americana* (Linnaeus 1758)

Whooping Crane

MATERIAL: Coracoids (2); scapulae (2); ulna; radii (2); carpometacarpus; tibiotarsi (4); tarsometatarsi (4). UF/FSM 15575–15589, 22552.

*Grus canadensis* (Linnaeus 1758)

Sandhill Crane

MATERIAL: Ulna; radius; tarsometatarsus. UF/FSM 15590–15591, 22554.

*Aramus guarauna* (Linnaeus 1766)

Limkin

MATERIAL: Humerus; tibiotarsi (3). UF/FSM 15325–15327, 20017.

*Rallus elegans* Audubon 1834

King Rail

MATERIAL: Coracoid; humerus; tibiotarsus; tarsometatar-sus. UF/FSM 22485–22488.

*Porzana carolina* (Linnaeus 1758)

Sora

MATERIAL: Tibiotarsus. UF/FSM 22558.

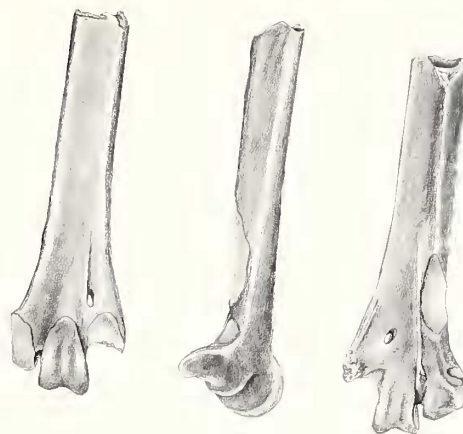


Figure 3. Referred left tarsometatarsus of *Milvago readei*, UF/FSM 22561, in anterior, internal, and posterior view.  $\times 2$ .

*Gallinula chloropus* (Linnaeus 1758)

Common Gallinule

MATERIAL: Coracoids (4); humeri (18); ulnae (6); carpo-metacarpi (5); femora (9); tibiotarsi (8); tarsometatarsi (13). UF/FSM 22371–22433.

*Gallinula brodkorbi* McCoy 1963

MATERIAL: Coracoids (2); humeri (3); ulnae (4); carpo-metacarpus; femora (7); tibiotarsi (5); tarsometatarsi (7). UF/FSM 22342–22370.

REMARKS: In a review of the Pleistocene rails of North America, Olson (1974) considered *G. brodkorbi* a valid species that was a large temporal representative of *G. chloropus*. Later, he synonymized *G. brodkorbi* with *G. chloropus* (Olson 1977), considering the former a subspecies of the latter. Both of us have examined the material from the Itchtucknee River and we agree that two forms are present, and that *G. brodkorbi* is distinguished from *G. chloropus* primarily on the basis of the larger size and greater heaviness, or stoutness, of its bones. But as Olson (1977) pointed out, the specimens McCoy (1963) referred to *G. brodkorbi* fall within the size range of Recent *G. chloropus*, possibly requiring future nomenclatural changes if no diagnostic characters other than size can be determined for the two forms when a larger series is available. Because of individual variation within gallinules I do not believe we have a sufficient number of specimens to detail specific osteological differences between the two forms.

A problem with considering *G. brodkorbi* a temporal subspecies of *G. chloropus* is that *G. chloropus* is also recognizable in the fauna and is represented by approximately twice as many specimens as *G. brodkorbi*. If one accepts the premise of Mayr (1963) that subspecies may form only if two populations of a species are isolated in space, than one must also accept the restriction that temporal subspecies must be isolated in time. Unfortunately, the specimens from the Itchtucknee River were recovered from the bottom of the river over its entire length, not in situ, so we do not know if the two forms were contemporaneous. Until further work on delineating the relationship between the two forms is possible, I prefer to maintain *G. brodkorbi* at the specific rank.

*Porphyryla martinica* (Linnaeus 1766)

## Purple Gallinule

MATERIAL: Humeri (4); femur; tibiotarsus; tarsometatarsus. UF/FSM 20040–20043, 22434–22436.

*Fulica americana* Gmelin 1789

## American Coot

MATERIAL: Coracoids (3); humeri (12); ulna; carpometacarpus; femora (4); tibiotarsi (28); tarsometatarsi (6). UF/FSM 20020–20039, 22437–22445, 22457–22482.

*Ectopistes migratorius* (Linnaeus 1766)

## Passenger Pigeon

MATERIAL: Tarsometatarsus. UF/FSM 22556.

*Zenaidura macroura* (Linnaeus 1758)

## Mourning Dove

MATERIAL: Humerus. UF/FSM 22557.

*Tyto alba* (Scopoli 1769)

## Barn Owl

MATERIAL: Carpometacarpus. UF/FSM 15573.

*Otus asio* (Linnaeus 1758)

## Screech Owl

MATERIAL: Humeri (2). UF/FSM 22489–22490.

*Strix varia* Barton 1799

## Barred Owl

MATERIAL: Femur. UF/FSM 15574.

*Corvus brachyrhynchos* Brehn 1822

## Common Crow

MATERIAL: Coracoid; humeri (2); ulnae (2); tibiotarsus; tarsometatarsi (3). UF/FSM 22538–22546.

## DISCUSSION

McCoy (1963) identified 392 avian fossils representing 52 species (with corrections to his identifications, 47) from the Itchtucknee River deposits. The 1362 specimens reported here represent 56 species. The total number of species (see Table 1) reported from the Itchtucknee River now stands at 67.

In his paper, McCoy (1963) described three new species: *Palaeophox columbiana*, *Anas itchtucknee*, and *Gallinula brodkorbi*. As mentioned earlier, *Palaeophox columbiana* is a synonym of *Botaurus lentiginosus*. *Gallinula brodkorbi*, although considered a temporal subspecies of *G. chloropus* by some (Olson 1977), is here considered a valid species. I have examined the type of *Anas itchtucknee*, but on the basis of the available comparative material, both fossil and Recent, I was not able to prove either that it was or was not a valid paleospecies. I did not find any additional specimens of anatids that could be referred to the species, and am inclined to doubt its validity. Late Pleistocene anatids are rather difficult to identify because of the close relationship of the living species to which we try to refer the fossils, and because of the large intraspecific size and osteological variation that occurs in that group. Large

series of comparative material are required to screen out this variation, and such series are not always available.

There are only seven (excluding the unknown accipitrid) extinct species, or 10 percent of the total number, present in the avifauna, and they represent only 3 percent of the specimens and 4 percent of the individuals recorded. If *Gallinula brodkorbi* is excluded, the six remaining extinct species represent only one percent of the specimens and three percent of the individuals. Thus, the portion of the avifauna consisting of extinct species is very small. When one considers that one species, *Ectopistes migratorius*, was recently extirpated by man, that two may be direct ancestors of living forms (*Gymnogyps amplus*—*Gymnogyps californianus*; *Gallinula brodkorbi*—*Gallinula chloropus*), and that only one of the others (*Ciconia maltha*) is reasonably well known, it becomes apparent that we are dealing with essentially a modern avifauna. Three of the seven extinct species (*Ciconia maltha*, *Gymnogyps amplus*, and *Ectopistes migratorius*) are also known from the deposits at Rancho La Brea, California, for which the oldest available date is approximately 40,000 B.P. In view of all of the above, McCoy's (1963) suggestion of a mid-Wisconsinan age for the Itchtucknee River deposits seems quite reasonable, and if this date is in error I would suggest that it is too old.

From an analysis of the fossil material he studied, McCoy (1963) concluded that extensive freshwater pond and marshy conditions prevailed at the time of deposition of the fossils. The additional material reported here completely supports his conclusion. Of the 20 most abundant species, only two, *Meleagris gallopavo* and *Pandion haliaetus*, are not strictly pond or marsh dwellers, although even the latter feeds primarily in the water. Only 17 of the remaining 47 species known from the avifauna can be considered non-aquatic, and they, plus *M. gallopavo*, make up only 12 percent of the total number of specimens, or 13 percent of the minimum number of individuals. The 26 species, 39 percent of the total, of grebes and anatids alone account for 62 percent of the specimens, or 58 percent of the minimum number of individuals. The predominance of aquatic birds and the lack of any species in the avifauna that could be considered marine strongly indicates extensive freshwater pond and marsh conditions.

The significance of *Milvago readei* in the late Pleistocene of Florida, in addition to what it suggests about evolution and dispersal patterns within the genus, lies in the implication that many avian species of South or Central American origin accompanied the large mammals of similar origin into Florida via the Gulf Coast Savanna Corridor during glacial periods. It would appear more likely that suites of savanna-adapted birds rather than just one or two species moved into Florida during the periods of lesser rainfall and more open country than now, only to retreat or become extinct when the climate returned to more humid conditions and the open country disappeared during interglacial periods. We should, therefore, expect to find additional South American forms in glacial-age deposits of Florida. We must also bear in mind that Florida could have acted as a major dispersal route for avian species that populated the Antilles.

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